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Implementing Interactive Multimedia Training

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ABSTRACT

This paper will provide a brief overview of the role of interactive multimedia in corporate training, and will discuss the relevant factors in making wise business decisions regarding the implementation of interactive multimedia (IM) within U.S. shipyards.

Despite the numerous studies and reports citing the efficiencies of delivering instruction in a multi-sensory format via a computer, shipyards have been slow to implement this technology into their business practices. The reasons for this are twofold. First the technology is still viewed as nascent and unproven. Second the business benefits are not well understood by decision makers.

This paper focuses on understanding the business benefits of implementing interactive multimedia in a shipyard environment. Case studies and success stories will be referenced for the purpose of understanding how interactive multimedia training works within the shipyard. The main thrust of discussion is towards how to properly analyze the expected return on investment and strategy for implementation of interactive multimedia within a typical shipyard.

RECOGNIZING THE OPPORTUNITY

The advancement of information technology has created a wealth of opportunity for companies to improve their business and manufacturing processes. Many years ago, engineers and designers saw the opportunity to improve their job efficiencies and capabilities through the use of computers. Subsequently, computer aided design, manufacturing, and engineering systems were born. Today, shipyards and other businesses are implementing advanced CAD/CAM/CAE (Computer Aided Design / Computer Aided Manufacturing/ Computer Aided Engineering) systems into their operations and realizing dramatic improvements in design and manufacturing efficiency when compared to only a few years before. The use of CAD/CAM/CAE within major manufacturing is no longer considered a strategic advantage; it is a necessity. Those that do not use it are at a competitive disadvantage with those who do.

Similar to the opportunity that information technology created through CAD/CAM/CAE, information technology has now made possible, through interactive multimedia the ability to deliver highly effective and economical training via computer. Although the concept of delivering instruction via computer is not new, the effectiveness of the delivered instruction has greatly improved. Current hardware technology and software tools now provide the ability to engage learners with graphics, sound video, and animation, and involve them through interactive lessons and simulations.

Numerous studies have validated interactive multimedia training as superior to traditional training methods for most learning situations. One study (Adams, 1992) showed that learning gains, measuring both understanding and retention of course content, was 56% higher with interactive methods versus traditional methods. The same study also showed that consistency of learning was 50-60% better, training compression (time saved) was 38-70% faster, and that content retention was 25-50% higher. Other studies (Adams, 1992) have informally measured long term content retention 350% higher than normal training content retention, six to nine months after the course was completed. These studies point to a dynamic new way of approaching training.

In addition, numerous corporations are currently validating the fact that interactive multimedia training represents a cost savings over traditional training methods. Xerox trained 14,000 customer-service engineers with over 200,000 hours of interactive multimedia training in 1992. In doing so they realized a 30% decrease in overall training time, which translated directly into less employee downtime and, consequently, significant cost savings. Delta Airlines is projected to save $2 million annually with an interactive flight attendant training program they implemented in 1992. Federal Express was able to reduce the time it takes to train management in quality assurance and problem solving from four days by traditional methods to only one day through interactive multimedia. Finally, Bethlehem Steel has been using interactive multimedia training since 1986, with great results. They find that this training's "zero travel time, flexible scheduling, self-pacing, high retention, continuous availability, and non-

threatening learning environment" (Educational Technology, 1992), give it a significant advantage over other training methods and contribute to the 40% reduction in Bethlehem Steel's overall training time.

UNDERSTANDING THE OPPORTUNITY

The same improvements in training effectiveness and reductions in training cost that the aforementioned companies are realizing can be realized by shipyards as well. Although interactive multimedia training is not appropriate for all situations, medium to large sized shipyards have characteristics that make interactive multimedia training a very attractive opportunity.

The initial cost to develop interactive multimedia is significantly higher than the initial cost to develop an instructor led course. However, once the training is developed, the cost of delivering the training is relatively small. When analyzing training costs, the real cost of delivery not only includes the cost of the instructor's time and materials, but also the cost of the students' time away from their presumably value-adding jobs. IM primarily creates cost savings through its ability to minimize training time, thereby increasing productive time.

In order for the relatively high development costs to be recovered by subsequent savings in delivery, companies typically must have a training need that affects a workforce that is either relatively large (500+) and/or geographically dispersed. Additional savings can be realized if a company trains on-shift in a multiple shift operation. By these general standards many medium and large sized shipyards can potentially benefit from interactive multimedia training. For these yards, a thorough understanding of the variables involved with the true costs of training is essential.

ANALYZING THE OPPORTUNITY

The technology of interactive multimedia has been proven, the benefits have been validated, and the application to shipyard-specific subject matter has been demonstrated (NSRP 1993 Ship Production Symposium Proceedings, 1993). The application of interactive. multimedia technology in training should no longer be viewed as risky and unproven. Similar to the maturation of CAD/CAM/CAE, IM training will soon cease to be a strategic advantage and will become a standard methodology.

Implementation of 3M begins by developing a decision making model which compares the costs of IM with those of traditional stand-up training. With the cost of interactive multimedia mostly contained in front end investment the cost-savings-benefit of IM is realized in delivery. Therefore, because of stand-up training's higher delivery costs, there must be a break-even point where IM becomes more cost-effective. This break-even point is calculated by determining the different costs associated with each training method.

Costs are divided between fixed and variable amounts. Fixed costs remain constant within an individual project. The fixed costs for IM training development include items such as course design, software development and hardware purchasing. The fixed costs for traditional stand-up training include course design content development printed training material, and presentation equipment. Costs vary between different projects based upon their scope and complexity.

"Variable costs change for the individual project. In the case of both IM training and stand-up training, the prevailing variable is the total number of employees that must be trained. In both cases the number of employees to be trained determines the total amount of productive work lost. With stand-up training, this variable also determines the total number of employees to be trained and the total instructor costs. The crucial piece of information for determining overall variable costs is the percentage of time saved through IM training versus traditional , training. At this time, the industry standard is 35%-45% time saved. The combination of fixed and variable costs provide enough information to setup a decision making model.

Opportunity **scenario**

The scenario used in this generic analysis is one which most shipyards could encounter. A shipyard has determined that workers lack knowledge of shipyard fundamentals, resulting in decreased productivity. These fundamentals include: general shipyard layout shipyard terminology, basic ship construction concepts and general safety rules. Management has decided that training is needed and in turn requests a cost analysis of the potential training methods. Finally, the training department has concluded that for the amount of detail required the course needs approximately 4 hours of traditional stand-up training.

The representative costs for traditional training are shown in Table 1

Fixed Costs (Traditional)	
Course Design & Content Development	$17,500
Printed Material	$12,000
Presentation Equipment	$2,000
Total Fixed Costs	**$31,500**
Variable Costs (Traditional)	
Worker's Salaries (either replacement costs or from lost revenue)	$160/worker (based on a $40/hr burdened rate x 4 hrs. training)
Trainer's Salaries	$12/worker (based on a $60/hr burdened rate x 4 hrs. training / 20 students per session)
Total Variable Costs	**$172/worker**

Table I

Representative costs for interactive multimedia training are shown in Table II:

Fixed Costs (Interactive)	
Course Design & Software Development	$70,000
Hardware Requirements	$2,500 (Assumes $25,000 initial purchase spread out over 10 lessons [5 yrs. avg. usefulness of computers x 2 lessons/yr.])
Total Fixed Costs	**$72,500**
Variable Costs (Interactive)	
Worker's Salaries (either replacement costs or from lost revenue)	$96/worker (based on a $40/hr burdened rate x 2.4 hrs. training [estimated time savings 60% x 4 hrs. traditional training)
Total Variable Costs	**$96/worker**

Table II

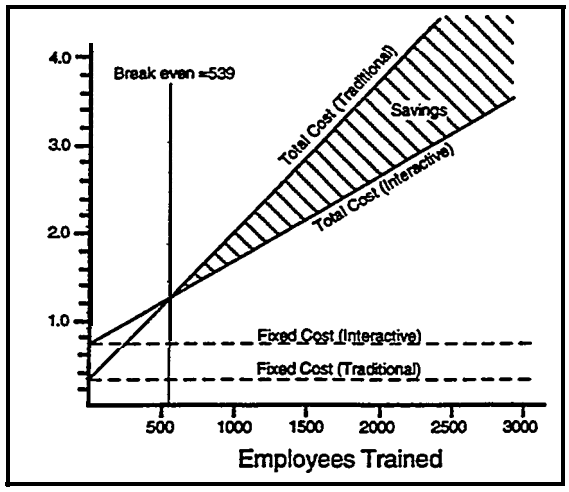

Figure 1

As shown in Figure 1, the break even point for this shipyard is approximately 539 employees. In this case, a shipyard that has training needs for 3,000 people over a span of five years would realize a cost savings of $187,000. This is for just one course of relatively short duration. Multiple courses of longer time spans would increase cost savings dramatically, quickly reaching millions of dollars.

Possible changes to variable costs. Increases to the break-even point will occur if instructors are deemed necessity to supervise trainees while they are at their workstations in the interactive model, or worker or instructor burdened rates drop (see Figure 2). Decreases to the break-even point will occur if travel expenditures have to be added for either students or instructors in the stand-up model, a simulation is involved that takes machinery off-line in the stand-up model, or worker or instructor burdened rates rise (See figure 3).

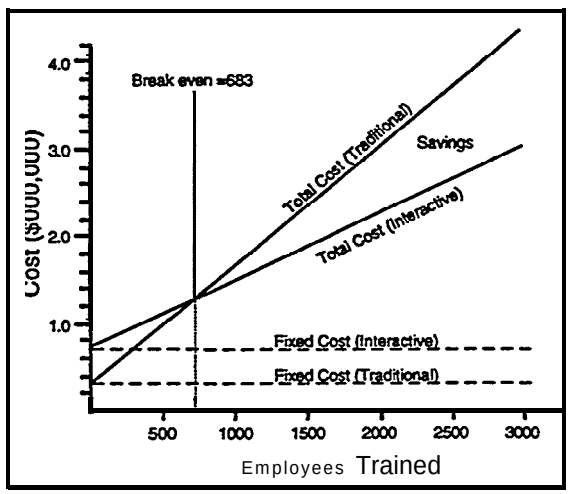

Figure 2 - $30/hour Burdened Rate

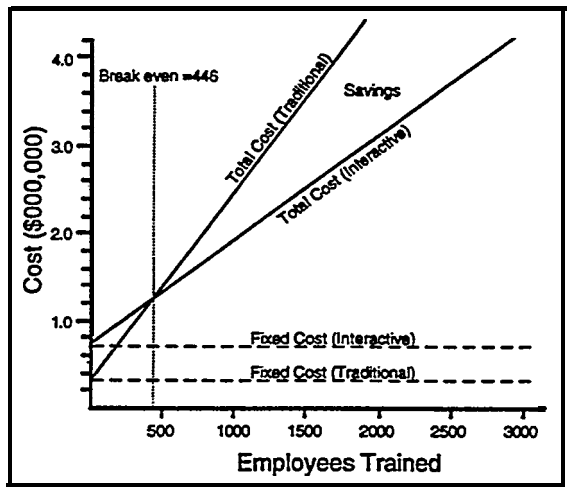

Figure 3 - $50/hour Burdened Rate

Other considerations. Some employees needing training have not yet been hired, so the lifetime of the training program, its ability to be updated, and employee turnover rate are important pieces of information needed to further understand the model. Also, equipment purchased for training that is multi-purposed, or reused for different tasks later on, must be considered when tabulating fixed cost expenditures.

Further Benefits. The value of self-paced instruction, other than training compression, should also be considered. Self-paced learning affects training availability, training effectiveness, and training consistency. Training employees at the moment of need (i.e. just-in.-time) results in a more efficient usage of resources. Employees who are trained consistently with high levels of comprehension of course content spend more work time being fully productive. An employee who is working at 8070 efficiency because of inadequate training, is losing the company money until fill training is achieved. Self-paced interactive multimedia training is the best way of eliminating this inefficiency.

ANALYTICAL MODEL

The above example was provided to show the various pieces of information that are needed to compare the costs of traditional training against interactive multimedia training. The numbers used were based upon the averages of the current market value for the services specified. In reality, these numbers vary by location and project. The following equation is provided to be used to determine the break-even point of the two training methods.

	Traditional Training	Interactive Multimedia Training
Fixed costs	• Content and course development • Printing test materials • Teaching aids and demonstration materials	• Software development and course design • Hardware costs
Variable costs	• Average burdened rate of trainees • Average burdened rate of trainees Ž Traveling costs per trainee	
Other Factors	Ž Total length of training time • Number of trainees per instructor • Training compression percentage (35-45% by most standards)	

Table III - Components of the Analytical Model

Calculating the Break Even Point (B_e)
Avg. rate trainees=A_e
Total training time=Tt
Avg. rate trainers=A_r
Arnt. trainees per instructor=A_i
Travel costs per trainee=Tc
Training Compression Percentage=C_p
Var. Cost per Trainee for Traditional Training=V_t
Variable Cost per Trainee for IM Training=V_i
Fixed Costs (Trad. Tr.)=F_t
Fixed Costs(IM)=Fi
Break even point=B_e

$$V_t=(A_eT_t) + ((A_rT_t)/A_i)+T_c \quad (1)$$

$$V_i=A_eT_t((100-C_p)\%) \quad (2)$$

$$B_e = (F_i-F_t)/(V_t-V_i) \quad (3)$$

IMPLEMENTING THE OPPORTUNITY

Once an analysis has been performed that indicates that interactive multimedia will save money, a plan of implementation must be developed. Ideally, the plan of implementation will be based on a long term strategy for implementing IM in a shipyard. However, in order to make a long term strategy a reality, upper management must first "buy-in" to the concept.

There are four steps involved in introducing interactive multimedia into a new environment

- undertake a small scale pilot that demonstrates that cost effective, custom IM can be developed and delivered within that yard
- use the cost savings data collected from the pilot to obtain upper management buy-in for further IM implementation;
- create a long term strategy for implementation, and
- begin implementation.

The Pilot

Despite the evidence and demonstrations that shipyards have been presented with that point to the benefits of interactive multimedia, it is best practice to test the water before jumping in with both feet. A small scale pilot project should be undertaken as a precursor to further, more widespread, development of interactive courseware. Ideally, the project should

- focus on achieving a well defined training goal,
- address a subject that is relevant to current training needs,
- have an overall development time of less than 3 months, and
- generate data to measure the project's success.

The pilot project's main goals are to familiarize the shipyard with multimedia development and delivery, while limiting their exposure to risk (i.e. unrecovered investment). This familiarization is intended to occur on many levels. First, those directly involved in the project will see, first hand, the issues faced in multimedia development and implementation. Next the training recipients will experience, perhaps for the first time, interactive learning. Finally, and most critically, decision makers will see the finished product and assess its business benefits based on the generated cost savings data.

A pilot project will require relatively high visibility in order to achieve its goals, so it is best to minimize the chance of failure by selecting subject

matter that is well understood and a scope that is well defined. This does not mean that the subject matter should be of trivial importance. It is important that the pilot be designed to address a real life training challenge in order to generate meaningful and credible data.

The scope of a pilot project should be such that the overall development time (the time a project team is first assembled to the time a final product is delivered) does not exceed three months. The three month time limit creates a sense of urgency, which discourages a bureaucratic, management by committee approach, and contains project costs at a reasonable level. A pilot should not be an academic case study; it should be a brisk trip through the IM development-delivery cycle, meant essentially, to break the ground for further development.

Obtaining Management Buy-in

Regardless of what subject matter is chosen, and what training need is addressed, the salient issue at hand is to determine whether the interactive courseware reduces costs relative to traditional methods. It is this information that will most significantly influence top decision makers. Therefore, monitoring of a pilot project must be designed to provide top decision makers with information that validates the claim that interactive multimedia training will save their yard money.

Precise statistical measurements of a pilot's effectiveness are not necessary for the information to be useful. The relevant point is that the results observed during the pilot concur with published reports on the effectiveness of custom interactive courseware developed elsewhere. With good information in favor of the use of IM, the logical choice for decision makers to make will be in favor of interactive multimedia. However, significant changes do not occur quickly, and one should expect a certain amount of "courtship" time in which decision makers become comfortable with interactive multimedia training.

Creating a Long Term Strategy

Once the appropriate decision makers have released the necessary approvals and resources to support continued IM training development, a long term strategy should be developed. The long term strategy should include considerations of the following three issues:

- consideration of IM in all training analyses;
- in-house or outsourcing IM development; and
- creating IM development and delivery standards.

After implementation of interactive multimedia into a shipyard's training environment has been effected, the method for analyzing training solutions must be changed to incorporate considerations for IM. All new training requests should be analyzed to determine which method of instruction, including interactive multimedia, is most economically and instructionally effective. Similarly, existing training efforts should also be analyzed. The prevailing variable that determines the cost effectiveness of IM is the number of workers trained over the life cycle of the training material. Even though training material exists on a certain subject, conversion of this material to interactive format may be warranted when the future life cycle is considered.

Following an analysis of training delivery methods that recommends IM, a plan for developing the interactive courseware should be developed. Depending on a shipyard's projected need for interactive courseware, the talent to develop the material should be either acquired in-house, through outside consultants, or a combination of the two. Typically, companies tend to ease into IM development by initially relying on outside consultants for development of courseware. As time progresses, many companies tend to bring a "skeleton crew" of IM developers on in-house to handle course maintenance and small, quick turnaround projects, while still relying on outside consultants for help with major development efforts.

Regardless of whether IM is developed in-house or by outside consultants, the shipyard will have to determine the development and delivery platform that is best suited for their environment. In considering hardware for development and delivery, the equipment should:

- integrate easily with existing information systems
- meet performance needs
- upgrade to future requirements

CONCLUSION

In the recent past, interactive multimedia was viewed as a risky and unproven technology. Now, there is sufficient information available to prove that this technology is viable in its ability to dramatically reduce training costs in a number of corporate environments. Multimedia has proven its validity in the corporate world. The question has now become not why to implement, but when to implement.

A model for analyzing the cost savings for interactive multimedia has been presented in this paper. The steps for implementation have also been discussed. It is now in the hands of shipyard decision makers to analyze their current training needs and determine the suitability of interactive multimedia within their individual yards.

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